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NATIONAL DEFENSE POLICY AND THE PROTECTION OF THE CRITICAL ENERGY INFRASTRUCTURE IN BRAZIL

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Introduction

The most diverse countries and regions of the planet have long faced the challenge of preventing and overcoming real or imminent situations that may in some way disrupt the security of their energy infrastructure, requiring ostensive and effective military intervention in the surveillance, control and defense of such environments. The cases are the most varied, including prevention and response to criminal actions against oil and gas wells and platforms, attacks on hydroelectric and nuclear power plants, refineries, wind and solar farms, transport ships, ports, tanks, oil and gas pipelines, among others, whether located in the continental or oceanic region. Problems widen and require different types of responses as cyber attacks on electronic information and monitoring systems, as well as the occurrence of natural events of catastrophic dimensions, are observed.

The onslaught of any internal or external agent against the critical or strategically valuable energy infrastructure of a State can cause the interruption or collapse of the supply of one of the most essential inputs to the maintenance of a country's survival and development conditions and of its society in general. And, among the many actions necessary to protect the energy production, commercialization and consumption chain, it is imperative to adequately organize the defense of such a complex through the actions of the armed forces (Navy, Army and Aeronautics), given the specific nature of certain threats. Since the critical energy infrastructure represents a capital

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element for a country, it is expected that the issue occupies a prominent place in the construction of its defense strategy.

Considering the context described above, this text presents an analysis on how the protection of Brazilian critical energy infrastructure is addressed within the scope of the national defense policy, seeking to better understand how the security of energy supply in Brazil is outlined. The analysis developed in this text is concerned with answering three basic questions: 1- Which are and where are located the main Brazilian critical energy infrastructures referring to the chain of oil, by-products and natural gas? 2- To which extent is the protection of these infrastructures provided for in the national defense policy, in particular, in the main documents dealing with the matter? 3- How is the planning of employment of Brazilian military power in the prevention and response to threats or attacks against the infrastructure related to the aforementioned sources?

In examining the national literature, it seems that there is not an adequate attention to this issue in the studies dedicated to energy security in Brazil, at least regarding a more specific and detailed approach to what is determined by the national defense policy on the protection of Brazilian critical energy infrastructure, except for a few rare exceptions (Demeterco 2014; Vicente 2014). In general, the issue is dealt with marginally in the context of issues related to security and national defense challenges (Silva and Costa 2009; Hage 2008), and to the consequences of possible conflicts in the face of instabilities in the regional contours (Nasser and Moraes 2014; Acioly and Moraes 2011), to the increase in transnational illicit activities (Reis 2011), to the disputes over the demarcation of maritime zones and sovereignty over natural resources (Silva 2013; Martins 2010), to the necessity of protection of oil and gas reserves in the pre-salt layer (Oliveira, Cepik, Brites 2013; Metri 2009), as well as to the possibility of confrontations resulting from the interference of extra-regional powers in the Atlantic and South America (Vidigal 2014; Thuswohl 2008).

The analysis of critical infrastructure protection developed in this article is embedded in issues related to the military dimension of energy security, which generally comprehends a discussion of the need to defend, through military action, both reserves and national structural energy complexes against threats that may affect its perfect functioning and maintenance of the livelihood and progress of society and the country as a whole. The approach from a militaristic or defense-related perspective will be based on scenarios and analysis that involve the use of force or of the other military devices related to energy disputes, criminal acts, military conflicts, operational incidents, or natural events, which may result in the partial or total interruption of en-

ergy supply.

The reflective and discursive universe of studies in the case of the military dimension of energy security tends to be centered on issues such as the identification of domestic or transnational threats of physical or virtual attacks resulting from the action of state or non-state actors against energy reserves or infrastructure. Similarly, it involves analyzing the offensive and defensive capabilities of a particular country, a regional security complex or the international community, against events that may cause instability to the energy supply or the lucrative flow of such resources to the consumer market. The major purpose of this reflection is related in general to the maintenance of the necessary conditions for the continuous and adequate energy supply at the national, regional and international level, depending on the sphere of analysis.

However, it is worth mentioning that studies and practices on the protection of critical energy infrastructure are much broader, since engineering systems, for example, suffer occasional equipment failures and require periodic maintenance, which implies measures that involve both private and public sectors, depending on the case (see Aradau 2010, Farrel et al. 2004). Similarly, energy security can have different dimensions ranging from political and military to technical and economic ones, noting, for example, that economists are mainly concerned with the macroeconomic impacts emanating from rising energy prices and the dangers of economic losses due to possible supply failures (see Ciută 2010; Bielecki 2002).

This paper seeks, therefore, to contribute, in some way, to the overcoming of a gap in the national literature, proposing a specific, systematic and in depth study on a specific aspect of the protection of the Brazilian critical energy infrastructure. In order to comply with this intent and answer the aforementioned questions, in addition to this introduction, the paper has four more parts. In the next section, the main objective is to present some conceptual frameworks on the subject, in addition to identifying which are and where are the main infrastructures of production, commercialization and consumption of energy in Brazil, especially those related to the chain of oil, by-products and natural gas, with the objective of obtaining a concrete reference point for the analysis of vulnerabilities and the answers necessary for its defense.

In the following section, the main scope is to verify how the security of energy infrastructure is effectively incorporated and treated as a military dimension in Brazil, in particular, to analyze how it conforms to the two main defense policy documents in the country: the National Defense Policy and the National Defense Strategy. The fourth section focuses on the evaluation

of aspects related to the planning of Brazil's military offensive and defensive capability, aiming at protecting the infrastructure related to the sources mentioned above, in the midst of the main (external) threats perceived by the Brazilian government and by scholars. Finally, final considerations are presented with some conclusions in order to systematize the results obtained from the reflections carried out throughout the text.

Critical infrastructure and energy security in Brazil: oil, gas and by-products

The concept of critical infrastructure in Brazil is precisely defined by Article 2 of Ordinance No. 2 of the Institutional Security Cabinet of the Presidency of the Republic (GSI / PR), of February 8 2008, which "Establishes Technical Groups for Security of Critical Infrastructures (GTSIC) and other measures". According to this ordinance "IEC [Critical Infrastructures] are considered as installations, services and goods that, if disrupted or destroyed, will have serious social, economic, political, international or national security impact." The Article 3 of the above-mentioned document lists, between items I and V, the priority areas of critical infrastructure, without prejudice to others that may be defined, with an energy-related infrastructure being nominally included. The others refer to the transport network, water, telecommunications and finance.

The aforementioned GSI / PR Ordinance, and no other official federal government document, currently establishes a precise definition of critical energy infrastructure in the country. In contrast to Brazil, Canada, for example, has the National Strategy for Critical Infrastructure, which, among other aspects, defines precisely the meaning of the term:

> Critical infrastructure refers to processes, systems, facilities, technologies, networks, assets and services essential to the health, safety, security or economic well-being of Canadians and the effective functioning of government. Critical infrastructure can be stand-alone or interconnected and interdependent within and across provinces, territories and national borders. Disruptions of critical infrastructure could result in catastrophic loss of life, adverse economic effects, and significant harm to public confidence (Canada 2009).

Based on the aforementioned definition, it can be said that the critical or strategically valuable energy infrastructure refers to the chain of extraction, production, processing, transportation, commercialization and consumption

of energy of fundamental importance to the survival and development of the country and its people in general, whose disruption or destruction can still have repercussions in the international sphere (Paiva 2015, 151). However, it should be emphasized that it is not any hydroelectric plant, pipeline, storage or logistics structure that has strategic value, but those that actually have the potential to cause the impacts previously mentioned and have a national or international repercussion (Demeterco 2014, 07).

With regard to the critical energy infrastructure in Brazil that involves oil, natural gas and by-products, it can be affirmed that much of it is located in or near the maritime area. In this sense, the essential structures mentioned initially include those located in the midst of Atlantic waters, and are related to hydrocarbon extraction, exploitation and storage bases, peculiar physical environments such as maritime transportation routes of energy resources, and watercraft, pipelines and other means of flow of fossil products extracted from the sea. On the other hand, there is also the infrastructure located in the coastal zone, which is related to the generation, processing, storage, transfer and transportation of energy resources. In this case, the following structural energy complexes are present in or close to the coastal zone: the centers of refining and storage of petroleum and production of derivatives; natural gas processing units; and the circulation pipelines of petroleum, by-products, natural gas, ethanol, solvents and others.

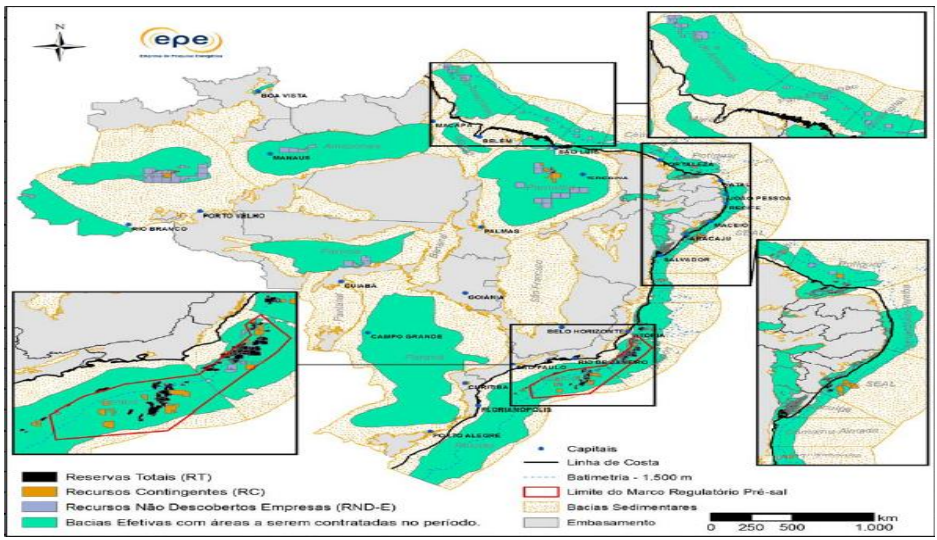
One of the starting points for understanding the relationship between critical energy infrastructure and the Brazilian Atlantic territorial extension lies in the fact that most of the proven reserves of oil and natural gas located in Brazil are found in the South Atlantic, respectively about 94.9% and 88.2% of the national deposits of these sources are in marine soil (ANP 2015, 70-73)[2]. Regarding oil production, official data reveals the same preponderant role of the South Atlantic, with 92.5% of this resource being produced from the sea (ANP 2015, 75). Gas production in offshore fields does not reach the same numbers when compared to oil, but they are no less prominent, since 73.3% of the country's gas originates from the ocean (ANP 2015, 82).

In the midst of this reality, it is worth noting that, according to data provided by the Brazilian Navy's Directorate of Ports and Coasts (Brasil 2016), in order to meet the economic exploitation of hydrocarbons derived from the

2 ANP Ordinance No. 9, dated 01/21/2000, defines proven reserves in the following terms: "Reserves of oil and natural gas which, based on the analysis of geological and engineering data, are estimated to recover commercially from uncovered and evaluated reservoirs, with high degree of certainty, and whose estimate considers the current economic conditions, the usually viable operational methods and the regulations established by Brazilian petroleum and tax legislation."

sea, there are 237 structural energy complexes in Brazilian waters, of which 177 were in operation and 60 were deactivated. This infrastructure refers to fixed, self-lifting and multi-legged platforms, drillships and probes and production, storage and transfer floating systems. As can be seen, from the cartogram below, most of them are found in the basins present along the Brazilian coast, given their predominance in such region.

Cartogram 1 - Effective basins in the areas of the Union and with the productive units in areas contracted with discovered and undiscovered conventional resources



Source: Ministry of Mines and Energy and Energy Research Company (MME, EPE 2015a, 241)

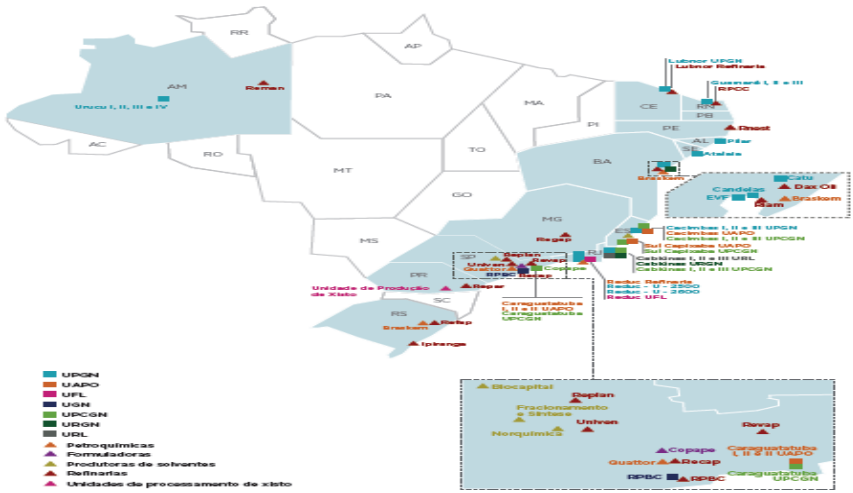
In addition to the infrastructural complexes linked to the oil and natural gas reserves in Brazil located in the oceanic region, there is also the infrastructure located in the coastal zone, which is related to the generation, processing, storage, transfer and transportation of energy resources. In this case, the following structural energy complexes can be highlighted: the centers of petroleum refining and production of derivatives; natural gas processing units; and the circulation pipelines of petroleum, by-products, natural gas, ethanol, solvents and others.

When verifying the geographic location of the 17 national industrial complexes responsible for the petroleum refining and the production of petroleum products in Brazil, it is verified that the majority is located in the

Brazilian coastal zone or in cities that are very close to the sea[3]. In addition to performing the refining process, such complexes are also responsible for the storage of most of the oil, petroleum products (gasoline, diesel, fuel oil, Kerosene aviation), intermediate products (turpentine and diesel) and ethanol that supply the country, whether originating from domestic production or from the external market. Similarly, when analyzing the location of the 15 national production centers that account for the processing of natural gas in Brazil, it is found that they are also located predominantly in the Brazilian coastal zone[4].

The cartogram below shows perfectly how close to the Brazilian coast the petroleum refineries and the centers of production and processing of natural gas, industrial complexes of great relevance for national energy security are.

Cartogram 2 - Refining and Processing Units - 2014



Source: National Agency of Petroleum, Natural Gas and Biofuels (ANP 2015, 105)

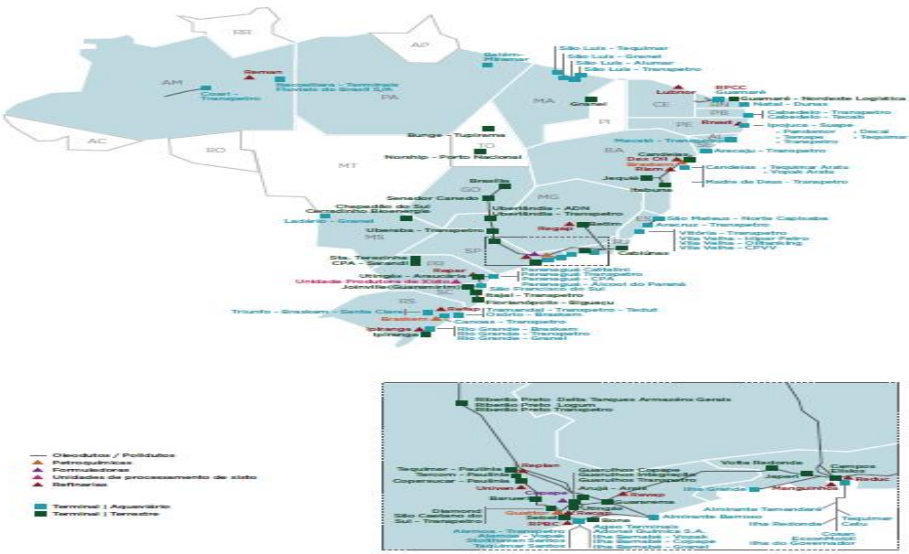
The movement of petroleum, by-products and ethanol in Brazil is also closely related to the Atlantic Ocean, since most of the storage terminals

3 The refineries are located in the states of Amazonas (Reman), Ceará (Lubnor), Rio Grande do Norte (RPCC), Pernambuco (Rnest), Bahia (RLAM and Dax Oil), Rio de Janeiro (Manguinhos, Reduc), São Paulo (Recap, Replan, Revap, RPBC and Univen), Minas Gerais (Regap), Paraná (Repar) and Rio Grande do Sul (Riograndense and Refap).

4 The processing centers are located in the states of Amazonas (Polo Urucu), Ceará (Polo Lubnor), Rio Grande do Norte (Polo Guamaré), Alagoas (Polo Alagoas), Sergipe (Polo Atalaia), Bahia (Polos Candeias, Pojuca and São (Polos Cacimbas and Sul Capixaba), Rio de Janeiro (Polos Reduc and Cabiúnas), São Paulo (Polos RPBC and Caraguatatuba) and Paraná (Araucária).

and pipelines carrying such resources are located near the Brazilian coast. The terminals are a set of properly equipped facilities for receiving, shipping and storing petroleum products and other fuels, which can be classified as maritime, fluvial, lacustrine and terrestrial[5]. The country has a total of 1,939 tanks, distributed in 108 authorized terminals, including 9 ethanol collection centers (21 tanks), 56 waterways terminals (1,442 tanks) and 43 terrestrial terminals (476 tanks). The waterway terminals concentrate most of the nominal storage capacity (69.6%) and the largest number of authorized tanks (74.4%) (ANP 2015, 113). Although there is a diversity of water and land terminals in Brazil, it can be seen from the map below that most are located in the Brazilian coastal zone.

Cartogram 3 - Petroleum and Derivatives Production and Movement Infrastructure - 2014



Source: National Agency of Petroleum, Natural Gas and Biofuels (ANP 2015, 117)

Regarding the infrastructure related to the movement of energy resources, it is important to highlight that there is a whole fleet of ships that cross the sea lanes. Cabotage navigation, for instance between ports and terminals within Brazil, is responsible for much of the transportation of oil and gas from offshore platforms to refineries, fuel distribution between coastal terminals, etc. (ANTAQ 2014). According to data from the National Agency

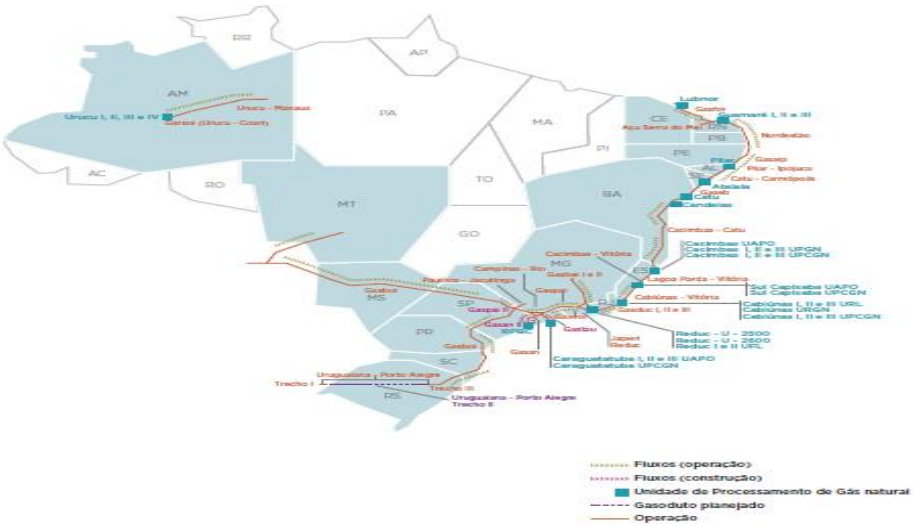
5 The definition was based on the one proposed on the website of the National Petroleum Agency at: <http://www.anp.gov.br/?id=582#t>. Accessed: May 22, 2014.

for Waterway Transportation, among the groups of merchandise transported in national cabotage in the first half of 2014, the movement of "Fuels, Mineral Oils and Products" stands out prominently, accounting on average for 76.5% of the tonnage handled in that period between Brazilian ports (ANTAQ 2014, 4).

The infrastructure related to energy movement in Brazil also includes pipelines, which contribute to the circulation of oil, by-products, natural gas and other products such as ethanol and solvents. By 2014, the country had 601 pipelines that stretched for 19.7 thousand kilometers. The most extensive part of the pipeline network is used in the movement of natural gas (gas pipelines), whose extension is 11.7 thousand km, using 110 ducts. These structures available for the circulation of oil and by-products (oil pipelines) total 422 installations that extend for 7.9 thousand km. The rest of the network (37 ducts - 76 km) is used to move other products, such as ethanol and solvents (ANP 2015, 116).

The cartogram previously shown (circulation of oil and derivatives) and the following (natural gas movement) show that a considerable part of these pipelines related to the energy infrastructure is close to the Brazilian coastal zone, once again revealing the importance of the country's maritime space because of the need to ensure national energy security.

Cartogram 4 - Natural Gas Production and Movement Infrastructure - 2014



Source: National Agency of Petroleum, Natural Gas and Biofuels (ANP 2015, 118).

The South Atlantic is equally important for Brazil as it represents the

main route of entry and exit of various energy resources to the country. The importance of these maritime routes in the export and import of petroleum, petroleum products and natural gas to Brazil is indisputable, especially when analyzing official data indicating where these resources circulate to reach the country. According to information available in the "AliceWeb" system of the Ministry of Development, Industry and Foreign Trade (MDIC), in the period from 2005 to 2015, practically all exports and imports of oil and by-products from Brazil - 99.9% - occurred through the Atlantic sea lanes[6].

From the data provided by the MDIC, also in the "AliceWeb" system, between 2005 and 2015, Brazilian natural gas exports are also mainly made through maritime transport[7]. Although the volume transported through oceanic routes is not equivalent to that of the export of oil and by-products, its relevance for the commercialization of Brazilian natural gas abroad is undeniable, as can be stated from the data table below.

In regard to the importation of natural gas, it is verified that the importance of maritime transport loses space. The main reason is the role of Bolivian gas in meeting the national demand, which occurs through terrestrial gas pipeline. However, it should be noted that between 2005 and 2015, the participation of the maritime route in the importation of natural gas has been increasing, mainly due to the increase in the acquisition of natural gas in the foreign market, in order to meet the growing demand of the Brazilian market.

Table 1 - Exports and imports of natural gas in Brazil by maritime route

EXPORTS											
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Volume (106 kg)	100,2	25,1	34,8	4,1	11,1	4,1	60,3	247,1	78,4	75,1	1,3
Maritime Route (%)	100	100	98,7	84,6	99,8	60,5	97,5	99,92	100	99,9	99,75
IMPORTS											
Year	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total Volume (106 kg)	1.061	1.756	2.107	3.714	2.359	4.037	4.529	5.959	7.997	15.286	16.856
Maritime Route (%)	7,2	10,48	11,34	12,43	21,53	34,44	24,35	33,47	39,30	40,57	44,64

Source: Ministry of Development, Industry and Foreign Trade ("AliceWeb" system)

6 The search in the "AliceWeb" system was done with the code "2709" for oil and "2710" for derivatives of the Mercosur Common Nomenclature.

7 The search in the "AliceWeb" system was done with the code "2711" of the Mercosur Common Nomenclature.

On the one hand, the dependence of the Brazilian market on imports of oil, by-products and natural gas requires the government attention to ensure that the roads through which these products arrive in the country are protected, so as to guarantee the domestic supply and indispensable means for national development. On the other hand, considering that the exports of such resources are an important source of dividends for the Brazilian economy, with a considerable rising trend for the next years (due to the pre-salt discoveries), it is a matter of safeguarding the necessary conditions for the appropriate use of opportunities for generating wealth for the country.

The next section will find out in which the extent the protection of this whole infrastructure is present in the main documents that deal with the national defense policy.

Protection of the Brazilian energy infrastructure of oil, gas and by-products in the national defense policy

Concerning the military protection of critical or strategically valuable energy infrastructure in Brazil, there is currently no legislation and official documents within the scope of the Brazilian federal government that deal exclusively with the issue in the sphere of national defense. On the other hand, the telecommunications sector already has a considerable political, institutional and conceptual framework, consolidated in official documents, among which we can highlight the "Basic guidelines to the manager of information and communication security: version 2.0" (Brasil 2016), the "Strategy of information and communications security and of cyber security of the federal public administration for 2015-2018: version 1.0" (Brasil 2015), the "Green paper: cyber security in Brazil" (Brasil 2010a), and the "Reference guide to the security of critical information infrastructures" (Brasil 2010b).

However, this does not mean that the main instruments of national defense policy guidance do not take into account the need to ensure the protection of the infrastructure of recognized strategic value for the country, including that related to energy. In this sense, one can highlight the predictions found in the National Defense Policy and in the National Defense Strategy. The former stands out as the highest-level document in national defense planning, establishing objectives and guidelines for the preparation and use of national military capacity. The other relates to the organization and orientation of the Armed Forces to better carry out their constitutional destiny and their attributions in peace and war.

The National Defense Policy refers to the "infrastructure of strategic

value" only twice, but does not use the term or bring specific directions in the sense proposed in the analysis presented in this text. Initially, the NDP uses the expression when it addresses "The regional environment and the strategic contour", highlighting the benefits of initiatives to promote infrastructure improvement in the South American region: "The expansion and modernization of South America's infrastructure can make the connection between its productive centers and the two oceans, facilitating development and integration" (Brasil 2005). The second mention occurs in the section that addresses the policies and actions that can contribute to the achievement of National Defense objectives, in expressing the need to "strengthen the infrastructure of strategic value for National Defense, primarily transportation, energy and communications" (Brasil 2005). The energy infrastructure, in this case, is considered much more as a means to promote national defense, and not properly an end to be achieved by the Brazilian military.

However, this does not mean that the NDP does not take into account the need to guarantee protection to the energy infrastructure of recognized strategic value for the country, especially that present in the waters or in the coastal area of the South Atlantic. However, such a forecast is made indirectly, as it can be observed through the extensive interpretation of other passages of its text.

The military defense of the Brazilian energy infrastructure would be safeguarded by the NDP - in the terms of the present study -, by establishing as a guideline that the planning of the national defense should include, as a priority, the areas where the greatest concentration of political, economic power and abundance of resources are found. In this sense, it specifically mentions coastal regions and Brazilian jurisdictional waters in the South Atlantic (Brasil 2005). In this case the NDP precisely points out that in this area are the largest national oil and gas reserves, as well as the main route through which almost all Brazilian foreign trade passes (Brasil 2005). In addition, it should be pointed out that this document emphatically indicates that there is a possibility in this century that disputes over energy sources and other scarce natural resources will intensify, which may become an object of international interest and interference in the internal affairs of other countries, leading to possible conflict scenarios (Brasil 2005).

In such circumstances, it is not sensible to say that the Brazilian Armed Forces are supposed to protect only the energy resources and the transportation routes of these goods, and ignore the defense of the related infrastructure, since in a case of conflict both would be, inseparably, menaced by conflicting agents. Possible disputes relating to the global scarcity of resources and the domain over specific natural assets, including energy, would

thus constitute an equal threat to the security of national energy-related infrastructure, given the inseparability of the issues in the promotion of security and national defense. As an essential element for the country's development, the Brazilian government could not disregard this factor as a central element in shaping the national defense policy, aiming to protect, among others, Brazilian energy interests in the South Atlantic region.

Considering the previous discussion, in the context of the National Defense Policy, the safeguarding of the Brazilian critical energy infrastructure in the Atlantic through national military power is based mainly on a debate regarding the protection of strategic resources and the domain of vital spaces over which the country must guarantee the exercise of sovereign rights. In this sense, it also reveals, in an objective way, the perception that energy is one of the central determinants of power and wealth in international relations, and may be the target of foreign greed. Because of this, in this intricate board, it is of capital importance for Brazil, and for any country in general, not only the defense of the energy sources themselves, of the area where they are and of the routes through which such resources circulate, but also the protection of any related infrastructure complex, without which it is not possible to operate all that chain, which allows to exploit energy economically.

The National Defense Strategy (2008), on the other hand, is much more objective and emphatic about the need to protect the infrastructure of relevant strategic value for Brazil, among which the ones related to energy stand out. First, the National Defense Strategy (NDS) emphatically confirms that the Brazilian government should have as one of its focuses the proactive defense of the oil platforms located in its jurisdictional waters (Brasil 2008), which, as previously mentioned, are responsible for most of the oil and natural gas production in the country. In addition, it also establishes as a priority the proactive defense of Brazilian naval and port facilities (Brasil 2008), precisely where a large part of the country's national infrastructure for storage, transportation and transfer of energy resources is located. In the same sense, it also emphasizes the need to be "[...] ready to respond to any threat, by State or by non-conventional or criminal forces, to maritime trade routes" (Brasil 2008), which consist in the main routes for circulation of energy resources in Brazil.

In general terms, the NDS also addresses the protection of critical infrastructure, including energy infrastructure, by planning the spatial distribution of military installations and the quantification of the means necessary to effectively address the national Armed Forces' Employment Hypotheses. The determination, in this case, is categorical in the sense that "[...] the National Defense System has the means to improve surveillance; to control airspace,

land borders, territory and Brazilian jurisdictional waters; and the national strategic infrastructure" (Brasil 2008, emphasis added). The insertion of this orientation in the field of the "employment hypotheses" of Brazilian military power is especially important since, given the indeterminacy and unpredictability of the latent threats to the country, strategic infrastructure is chosen as a priority object in national defense planning.

In another passage, the protection of energy infrastructure of vital importance to Brazil is once again recognized by the NDS, in this case, for representing a determining factor for national development. In this sense, it determines that the Ministry of Defense, in planning the spatial distribution of the Armed Forces in the national territory, prioritizes, among other things, "the maintenance of troops in the center-south of the Country to guarantee the defense of the main demographic, industrial and economic concentration, as well as that of infrastructure, particularly the energy generator" (Brasil 2008, emphasis added). The directing of the troops in this continental region of the country ends up focusing exactly where much of the energy infrastructure that is connected to the South Atlantic - as demonstrated in the previous section - is found, whether in the ocean waters or in the Brazilian coastal zone.

The National Defense Strategy then states that the increase in the level of National Security should emphasize "[...] measures for the security of critical infrastructure areas, including services, in particular with regard to energy, transport, water and telecommunications "(Brasil 2008, emphasis added). As stated in the NDS, the increase in the level of National Security will be incumbent upon all instances of the State. However, in the case of the aforementioned structural complexes, the responsibility lies with the "Ministries of Defense, Mines and Energy, Transport, National Integration and Communications and the coordination, evaluation, monitoring and risk reduction duties carried out by the Institutional Security Cabinet of the Presidency of the Republic (GSI / PR)" (Brasil 2008). By virtue of this determination, it is understood why the definition of the concept of critical infrastructure fell precisely to the Institutional Security Cabinet of the Presidency of the Republic, as previously cited.

The establishment of this safety net undoubtedly has as one of its focus the concern with the maintenance of national energy security, given its strategic condition. In this context, both the National Defense Policy and the National Defense Strategy guide the Brazilian government to be diligently prepared and have the means to respond appropriately to threats from internal and external agents that may inflict some sort of constraint on its energy interests.

The following section will verify how the planning of force employ-

ment of the Brazilian military power takes place regarding the prevention and response to threats or attacks against the infrastructure related to the oil, gas and by-products chain mentioned above.

Strategies of Brazilian military action in the defense of the national energy infrastructure of oil, gas and by-products

The National Defense Strategy outlines in a specific way how actions should be developed in order to exercise surveillance and defense of jurisdictional waters and the Brazilian coastal zone, which will directly and indirectly affect the protection of Brazilian critical energy infrastructure. In this sense, it establishes primarily that the main role in the defense of this space will be in charge of the Brazilian Navy, developing its actions towards three objectives: denial of the use of the sea, control of maritime areas and the projection of power (Brasil 2008).

The way in which the Brazilian Navy will implement these objectives, according to the aforementioned document, will be unequal and joint, in order to respond effectively to the challenges presented (Brasil 2008). According to the NDS, the priority will be to guarantee the means to deny the use of waters under Brazilian rule, in order to counteract any concentration of enemy forces that may approach Brazil by sea (Brasil 2008). The denial of the use of the sea to the invader is therefore considered the reference point for the organization of Brazil's maritime defense strategy.

The denial of the use of the sea to the enemy is defined by the Brazilian Navy in the following terms: "Basic task of Naval Power that consists of hampering the establishment of control of maritime area by the enemy, or the exploitation of this control through the destruction or neutralization of its naval forces, the attack on its maritime communication lines and points of support" (Brasil 2007, 168). The main purpose of this measure is, above all, to prevent enemy forces from advancing or remaining freely in Brazilian waters, land and airspace. The main action in these cases is to impose different obstacles on the invaders, thus preventing them from investing in any way against the country.

There are a variety of situations that may require denial of the use of the sea by the Brazilian Navy because it has a negative impact on the security of Brazilian critical energy infrastructure in the South Atlantic. Current literature from both civil and military academic circles usually mentions at least four types of threats (see Paiva 2015, 159-194). The first threat is the neo-traditionalist, which in reality are 'old threats' that stem from unlawful actions

such as piracy, terrorism and illegal trafficking (Reis 2011). The reports from the United Nations Office on Drugs and Crime (UNODC 2013), for example, accurately point to the South Atlantic, especially Brazil, as an important route for crimes relating to illegal transnational flows involving money, drugs, arms and people. During the Navy's Blue Amazon operation, held in February 2014, part of the training was the retake of an oil platform, considering that a terrorist group was aiming to control this infrastructural complex (see Mathias 2014).

The second is the instability of the countries bordering the South Atlantic, as internal political, economic and social vicissitudes may transcend borders and become a threat to Brazil's energy security. One focus of Brazilian concerns is the Gulf of Guinea, on the west coast of Africa, a region close to areas where a considerable part of Brazil's oil and natural gas production is located. This may jeopardize Brazilian energy production, the flow of energy resources in the maritime routes that cross the region, as well as all related critical infrastructure (Amroim 2013; Fiori, Padula, Vater 2012; Fonseca 2011).

The third threat refers to the plea against Brazilian sovereignty over its jurisdictional waters in the South Atlantic, which may address Brazil's exclusive possession over the areas where the energy sources and all the stationary and mobile infrastructure present in that territory are located. The Defense White Paper (Brasil 2012c, 45) alludes to the possibility of conflicts arising from disputes involving the delimitation of sovereign rights over the maritime territorial extension of Brazil. In this regard, it points out that although 152 countries have ratified the United Nations Convention on the Law of the Sea, there are still non-adherent countries, including major powers, which in the future may become a source of disputes. The questioning of Brazilian property of the areas surrounding the pre-salt region could trigger a conflict (Oliveira; Cepik; Brites 2013, 4), which would certainly also jeopardize all critical energy infrastructure.

The fourth threat would come from the actions of extra-regional powers seeking to preserve their interests in the South Atlantic zone. Regarding the international oil trade, "Due to its geographic and nautical characteristics, the South Atlantic basin allows the rapid transportation of large commercial volumes, particularly the ones that goes through the Cable Route where 66% of European oil and 26% of North American oil pass" (PENHA 2011, page 222). This scenario is a threat to Brazilian energy security due to the zones of instability that can be created if the interests of these extra-regional powers in the South Atlantic are countered .

According to the NDS, the defense of the national critical energy infrastructure also requires the control of the maritime area, whose definition

is also established by the Brazilian Navy in the following terms: "Control that aims to guarantee some degree of utilization, even if temporary, of limited, stationary or mobile maritime areas, exercised in the intensity appropriate to the execution of specific activities "(Brazil 2007, 68). The primary intention of maritime area control is to ensure that the region is continuously monitored so as to maintain the necessary conditions for its proper use according to the national interests. Under such circumstances, Brazilian naval power is employed in ordinary or extraordinary actions involving the daily surveillance of the national maritime space. If necessary, the effective response in case of real or notable danger will be carried out from the denial of the use of the sea, as previously demonstrated.

Regarding the defense of the national energy infrastructure, the control of the maritime area is of great relevance, especially in times of peace, and would, for example, ensure, through the monitoring of routes, the coordinated and uninterrupted flow of international energy resources trade for the country. On the other hand, surveillance would also focus on constant attention to the natural, stationary and mobile resources that are found in Brazilian jurisdictional waters in the South Atlantic, whether or not they belong to the country, thus ensuring that national production of oil and natural gas develops regularly in the region. In addition, constant patrols and monitoring would also play a significant role in preventing and restraining environmental damage from problems on oceanic platform of fossil fuel extraction, or from watercraft carrying such resources, facilitating a faster and more effective response.

A key factor in this task is the development of the Brazilian Surveillance System (SISBRAV), which will integrate all the country's monitoring and control systems, including the Blue Amazon Management System (SISGAAz). The latter will function as a monitoring and control system for maritime security and for the protection of the Brazilian coast. The intention is to make SISGAAz the Navy's main command and control system, aimed at managing activities related to the sea that involve surveillance, monitoring, prevention of pollution, natural resources, among others. Besides, it aims to increase knowledge about the maritime environment and the positioning of naval operations to respond promptly to crises or emergencies occurring on the Brazilian coast (Brasil 2012c, 71-72).

The Brazilian Armed Forces are constantly carrying out training, system alignment, testing and tactical procedures exercises for the defense of jurisdictional waters and the national coastal zone, which include the protection of energy resources, related infrastructure and routes where most of these goods circulate in the country. In this sense, we can mention Operation

Atlântico, which consists of one of the main joint interventions of the Armed Forces in the Brazilian coastal and oceanic area, whose third version (held in November 2012) was attended by approximately 10,000 military personnel. According to information from the Ministry of Defense, integrated actions included exercises to protect national critical energy infrastructure, both in deep waters and in coastal regions, with one of its focuses being ports, refineries and hydroelectric and nuclear power plants[8].

The second edition of Operation Blue Amazon, was held in March 2015, under the coordination of the Naval Operations Command of the Brazilian Navy, which deployed the largest number of troops and means used simultaneously in Brazilian waters, and had as objectives the intensification of the enforcement of laws and regulations and the repression of illicit acts of all types. During Operation Blue Amazon, the Brazilian Navy carried out, in addition to other activities, exercises to defend ports, oil and water terminals, and, with the support of Petrobras and Transpetro, conducted exercises in the Campos Basin, focused on the security of oil platforms and of ships moving in the region[9].

Finally, the protection of the national critical energy infrastructure by the Brazilian Navy involves the projection of power, which refers to the "Strategy that is developed through cross-border military participation, in situations that allow international respect for the country, for own initiative or in response to requests from external agreements, in order to dissuade potential aggressors and to support national interests related to the maintenance of international peace" (Brasil 2007, 99). The objective of this strategy is related to the expansion of Brazil's maritime military capacity, so that it is able to contribute to the formation of national interests not only in its territory but also in external areas or "targets", precisely through imposition of force or the threat of its employment. In this sense, the National Defense Strategy states literally that "projection of power in the areas of strategic interest" is one of the "desired capabilities for the Armed Forces" of Brazil (Brasil 2008).

In the context of energy security - including the defense of the national energy infrastructure - the importance of the *projection of power* emerges at the moment when the Brazilian government conceives the need to act through

8 Information from the website of the Ministry of Defense of Brazil. Available at: <http://www.operacoes.defesa.mil.br/web/guest/atlantico-3?p_p_auth=LMPxlyD6&p_p_id=56&p_p_lifecycle=0&p_p_state=maximized&p_p_mode=view&p_p_col_id=column-3&p_p_col_count=1&_56_groupId=10138&_56_articleId=53544#.U5a5M_ldVps>. Accessed: 12 December 2015.

9 Information from the website of the Brazilian Navy. Available at: <https://www.mar.mil.br/9dn/noticias2015_mar_resultados_amazonia_azul.html>. Accessed: 22 April 2016.

the expression of military capacity before the actors (state or non-state actors) who operate in the international order, exercising it through effective postures and measures, which can generate conditions of cooperation or conflict in different contexts. Brazilian military actions in this regard may be necessary in the scenario of interdependence and competition that characterize world energy trade, with the aim of preserving national interests in its own territory, or with countries which either supply or consume energy resources. Brazil's objective in such circumstances may range from stimulating or strengthening national prestige to limiting the power of influence of other nations. However, it is important to emphasize that the National Defense Strategy is particularly emphatic in pointing out that in this international insertion, "Brazil will rise to the forefront of the world without exerting hegemony or domination" (Brasil 2008, 01).

According to this prediction, Brazil should have the military capacity to warn or ward off any threat in certain circumstances. Regarding this debate, former Minister of Defense Celso Amorim (2013) highlighted the importance of the Submarine Development Program (Prosub), created in 2009, which provides Brazil with the possibility of constructing submarines, including of nuclear propulsion, which leads the country to another level in international relations. However, all this has a cost, which consequently increases the country's international visibility and imposes greater challenges for the government and Brazilian society. The projection of power would not properly be an absurd, but something even desirable, but one has to realize that it is "[...] one of the most complex and expensive tasks for a Navy, since it implies not only a Marine Corps In permanent readiness [...], but large ships and some sort of airdrome ship" (Bertonha 2009, 25).

Facing some uncertainties, it is not absurd to say that the Brazilian leading role in energy, or any other reason, can lead to antagonisms in times to come, which is not to say that the country should transform into any form of a war machine, but rather that it should be prepared to protect its national interests in the South Atlantic region. The demand for energy resources in this area, for example, can overcome the economic dispute, becoming a "game" that may involve the projection of military power, so as to gain privileged positions in the energy supply markets among countries in the region. From this point of view, considering both the protection of Brazil's critical energy infrastructure and national security as a whole, the South Atlantic "[...] should be regarded as an important means of projecting power, of defense and security of territories of the countries located on both its sides, requiring an active presence of these countries capable of enforcing their rights and interests" (Fiore, Padula, Vater 2012, 133-134).

By establishing effective actions for the advancement of hostile forces, denial of the use of the sea, maritime area control and power projection are therefore of fundamental importance for active and concrete Brazilian energy security, as it improves the protection network of the complex national energy chain in the South Atlantic (including platforms, drill rigs and production, storage and transfer floating systems) and energy infrastructure located in the coastal zone (transfer/storage port terminals, oil and gas pipelines, refineries, etc.).

Final thoughts

The issues that were dealt with in the present study regarding the critical and strategically valuable energy infrastructure for Brazil allow us to reach some conclusions. These conclusions deserve to be highlighted and presented clearly, so that specific scenarios and challenges could be taken into comprehensive awareness by the government, society and other national actors seeking to establish strategies for the sustainable development of the country over the years.

One of the conclusions to be highlighted, initially, is that the protection of energy infrastructure of strategic value for Brazil is related to discussions on national security and defense. According to the analysis carried out, the protection of Brazilian energy infrastructure is conceived as a security issue insofar as it is identified as a determining factor for the preservation of national sovereignty and territorial integrity, for the promotion of national interests, free of pressures and threats, as well as an element that guarantees Brazilian citizens the exercise of their constitutional rights and duties. On the other hand, it is a question of national defense because the security of such complexes requires, among other initiatives, a set of State measures and actions, with emphasis on military expression, against preponderantly external, potential or manifest threats, which are also intended to guarantee the protection of the territory, sovereignty and national interests. This perception about the framework of the protection of critical energy infrastructure in Brazil as a matter of security and national defense also derives from and is in perfect harmony with the definition given to the referred themes in the NDP (Brasil 2005).

The second conclusion to be highlighted is that the analysis performed throughout this paper showed that the South Atlantic and the Brazilian coastal region are particularly important areas for Brazilian energy security, not only because the main oil and natural gas reserves are located in

these spaces but also, and not least, because most of the critical infrastructure related to the production, commercialization and consumption of such resources in the country is located there. Brazilian jurisdictional waters include complexes that are essential for the economic exploitation of hydrocarbons, such as fixed, self-propelled and multi-legged platforms, drillships and production, storage and transfer floating systems, as well as oil and gas pipelines. In the coastal zone, we can highlight the industrial complexes of petroleum refining, production of derivatives and the centers of production and processing of natural gas in Brazil, as well as several complexes of pipelines, ports and terminals for receiving, shipping and storage of various energy resources that supply many regions of the country.

The onslaught of any enemy agent from the South Atlantic may result in the loss of Brazilian control over the country's main fossil energy producing region and the destruction of a significant part of the national energy infrastructure, thereby causing disruption of the supply of essential resources the country needs, whether to ensure its survival and development in general, or to maintain its "war machine". In all these circumstances, one can perceive the risks to which the country's energy interests may be exposed if due attention is not paid to the role that the armed forces should play in the oceanic region under Brazilian domain and in Brazilian strategic contours.

The third conclusion that has been reached refers to the evaluation of the insertion of the protection of energy infrastructure of strategic value for Brazil in the main documents that guide national defense policy, specifically in the National Defense Policy (2005) and in the National Defense Strategy (2008). Summing up, it can be argued that such documents objectively record concern about the possibility of international conflicts over scarce resources, including energy, and other external threats that may affect national energy security. Faced by this, they emphasize the need to defend, through the armed forces, trade routes, national energy sources and infrastructures, against threats that can directly affect domestic supply. A general analysis allows asserting above all that the defense policy in force in Brazil includes as one of its objectives to meet the imperative of maintaining the continuous supply of energy in the country, considering it as a priority issue.

More specifically, it can be said that the NDP makes no direct reference to the protection of the country's critical energy infrastructure, which does not mean that it ignores the issue. The military defense of such complexes would be guaranteed by the PDN to the extent that the use of offensive and defensive national military power focuses on the protection of strategic resources and the domain of vital spaces where they are, including, specifically, the coastal regions and the Brazilian jurisdictional waters. On the other

hand, the NDS is emphatic about the need to protect energy infrastructure of significant strategic value for Brazil, with direct guidelines on the proactive defense of oil platforms, naval and port facilities, as well as the safeguarding of the energy generation productive complex in general, including those located in the South Atlantic area.

Finally, the fourth conclusion from this analysis identified that the Brazilian Navy has the primary role of protecting, controlling and monitoring the national energy infrastructure complex that is located in the Brazilian maritime territorial extension in the South Atlantic. The actions, in this sense, include the denial of the use of the sea, the control of maritime areas and the projection of power. It is also worth mentioning that Brazil's position on the military dimension of national energy security is that of a security provider, not admitting the possibility of delegating such mission to other countries, nor does it pretend to be a mere spectator in the strategic-military situation in the region.

Last but not least, one aspect that should be emphasized, still within the scope of the fourth conclusion, is that the military actions for the maintenance of Brazilian energy supply have an impact on other issues of the national interest, such as: the promotion of foreign policy (cooperation in the area of defense with bordering countries), environmental protection (containment of damage due to oil platforms problems), maritime commercial development (protection of ports and maritime routes), generation of technology, employment and income (driven by the Brazilian defense industry).

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ABSTRACT
The study developed in this paper aims to analyze how the protection of Brazil's critical energy infrastructure is dealt with under the national defense policy in order to better understand how the military dimension of energy security is outlined in Brazil. With the intention of achieving this goal, it seeks, initially, to identify which are and where are located the main Brazilian critical energy infrastructure relating to the oil chain, petroleum products and natural gas. Next, it aims to examine the extent to which the protection of such structural complexes is provided for in the national defense policy, particularly in the main documents dealing with the subject in the country. Finally, it observes how is the planning of the Brazilian offensive and defensive military power in the prevention and response to threats against the infrastructure related to the above-mentioned sources.

KEYWORDS
National defense policy; Energy security; Critical infrastructure.

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